



MSR 2011 Paper 45: Implementing Quality Metrics and Goals at the Corporate Level



Pete Rotella & Sunita Chulani

protella @ cisco.com, schulani @ cisco.com

Cisco Systems, Inc.

May, 2011

Problem Statement

by 2005, customers had become increasingly upset about the quality of Cisco software

the 35 business units had no corporate standard development/test practices, quality metrics, or quality goals.

Background

BU GMs typically cherry-picked quality data to report to Engineering head

in 2005, Engineering head tasked the central quality/process team to find ways to provide the true quality picture.

Step 1: Implement SW Quality Dashboard

SWQD had been developed in a large BU, but no other BUs had been integrated

counting rules were standardized, and several yearly metric goals started in 2002

in 2006, we integrated all BUs into SWQD.

Software Quality Dashboard

Sponsored by The CDO Customer Experience Board (CEB)

SWQD Home > Organization View > CDO > DSO

Welcome to the FY11 Iteration of the CDO SW Quality Dashboard (SWQD).

- FY11 SWQD is built to support the CDO FY11 SW Quality Goals. This dashboard displays the metrics that are selected by the CDO Development Council as the common metrics range across three dimensions (organization, product and release)
- These metrics are updated on a weekly, monthly, and quarterly basis. The update schedule can be found [here](#)
- The goals (set by each TG/BU) for the common (aka Primary) metrics for FY11 can be found at [EDC S-891412](#)
- Additional supplemental metrics are also displayed for your information and reference purpose. Supplemental Metrics are not goalled.
- The SWQD FY10 archive can be seen at: <http://www.in.cisco.com/cgi-bin/ops/metrics/swqdfy10/index.cgi>

"For any questions or issues, please [Open an Incident](#)."

Search for relevant dashboard at the top of the page (example: type 'swq' for SW Quality Dashboard, 'qp' for Quality Plan Dashboard). Pressing enter will take you to a page. Pick the relevant service type (Bug/Error, Enhancement, General Inquiry, Usage Metrics) and click 'Request Now' to submit an incident. You can track the progress by clicking navigation menu.

Executive Summary for DSO

Metric	Responsible Manager	Primary Metrics					Supplemental Operating Metrics	
		CFD Incoming	CFD MTTR	% RNE	DPAI	% CFR	% REGR	% CFD
Tech. Group		504.8	31	94.7	93.9	13.69	19.4	5.5
		3.3	100.6	83.3	100	10	32.39	2.4
		156	18.9	95.4	98.7	10.74	24.71	5.3
		345.3	37.5	94.3	96.3	15.47	15.08	5.6

Product Summary for DSO

Metric	Primary Metrics					Supplemental Operating Metrics						
	CFD Incoming	CFD MTTR	% RNE	DPAI	% CFR	% CFR (NUM)	CFD Backlog	% CFD	TEACAT MTTR	IFD MTTR	SWDPM	SWDPMH
Product	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	52	15.5	97.1	100	8.1	3	11.9	6.1	1013.5	20.8	N/A	412.2273

SWQD

Search GO

Navigation

- Home Page
- Misc Process Descriptions
- Download Metrics Report
- Join User Alias
- Help
- Quality Plan View
- Organization View
- Product View
- Quality Plan Exec View
- Release View
- Component View
- Super Component View
- CSAT View
- Cost of Poor Quality View
- Dev PC Dashboard
- O&C Dashboard
- PRRQ Dashboard
- HVV Metrics Dashboard
- CA Dashboard
- Manager Quick View

Enter Manager GO

Include Direct Reports

Legend

- Far from Target
- Near Target
- Meets Target

<http://www.in.cisco.com/cgi-bin/ops/metrics/swqdfy10/index.cgi>

Key Data Mining Constraints

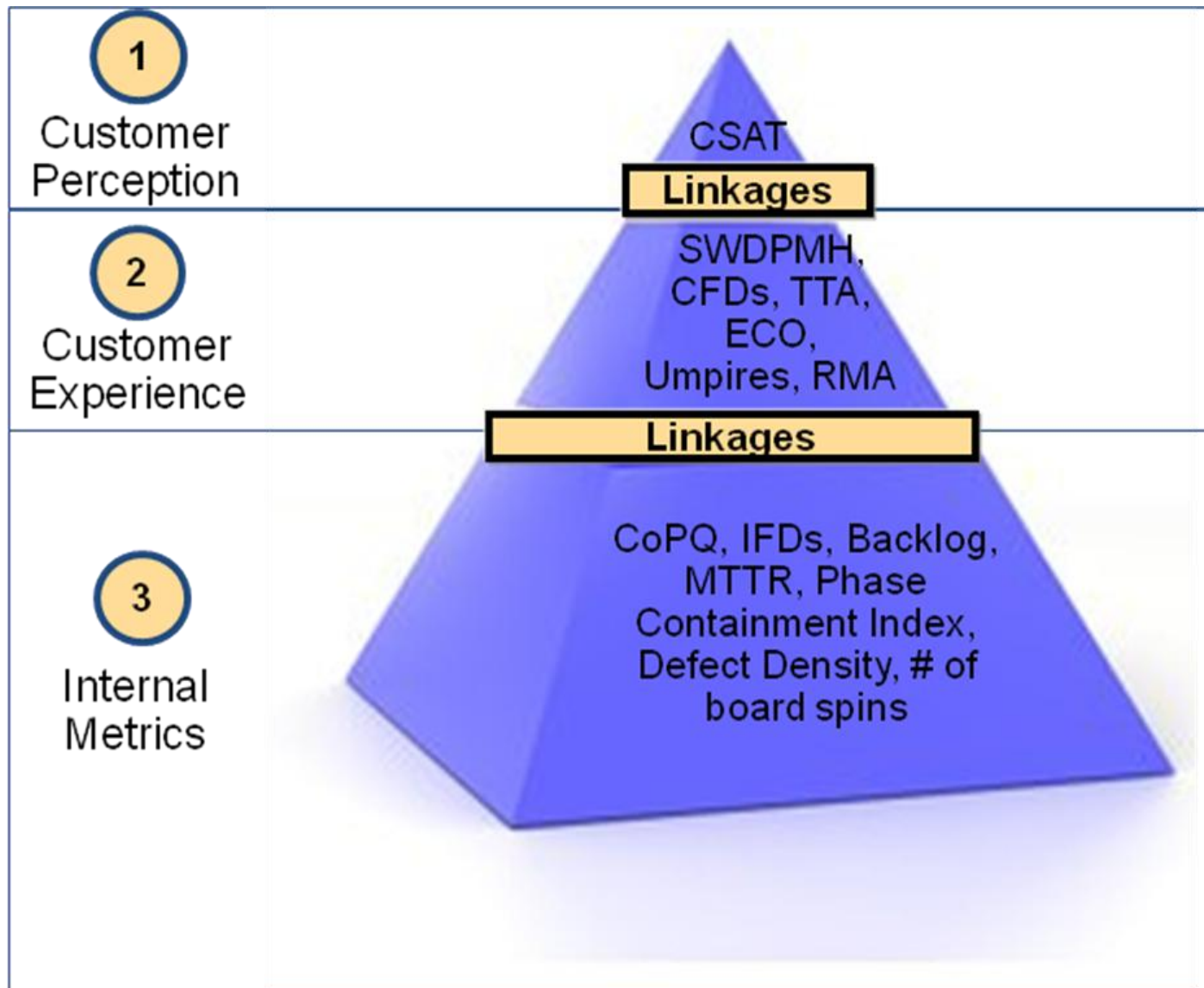
- accuracy – the published metrics data must be extremely accurate
- timeliness – daily status for key (common) metrics, weekly for most, monthly for some
- drilldown – to bug reports or service request reports wherever possible
- reorgs – periodic historical reruns to accommodate shifts in engineers
- changing history – bug reports and service requests change over time, so time awareness is important.

Step 2: Implement Common Metrics

‘common metrics’ is core set of in-process, customer experience, and customer perception metrics that are goaled across all Engineering

currently, we have 9 common metrics – the specific metrics and number of metrics has evolved over the past 6 years.

Core Idea A: Quality Pyramid



Core Idea B: Best-in-class Basis

corporate goal (established in 2009):
Cisco to be 'quality brand' by 2013

definition 1: top 10% of telecomm/
operating systems sector

definition 2: 4.4/5.0 customer satisfaction
survey (CSAT) threshold level (to achieve
>30% product market share).

Step 3: Implement Goaling

using # years to BIC decided on, we provide goal recommendations to each BU

BUs come back with their proposals, and negotiations occur

once goals are settled upon, we report to GMs and Engineering head quarterly

at year end, we give quality awards to best quality, most improved, and most innovation in software engineering/quality.

In-process Metrics

several hundred in-process metrics are published on SWQD, but only a portion of the adoption metrics are goaled

BUs are resistant to corporate goaling of in-process effectiveness metrics.

In-process Metrics Results

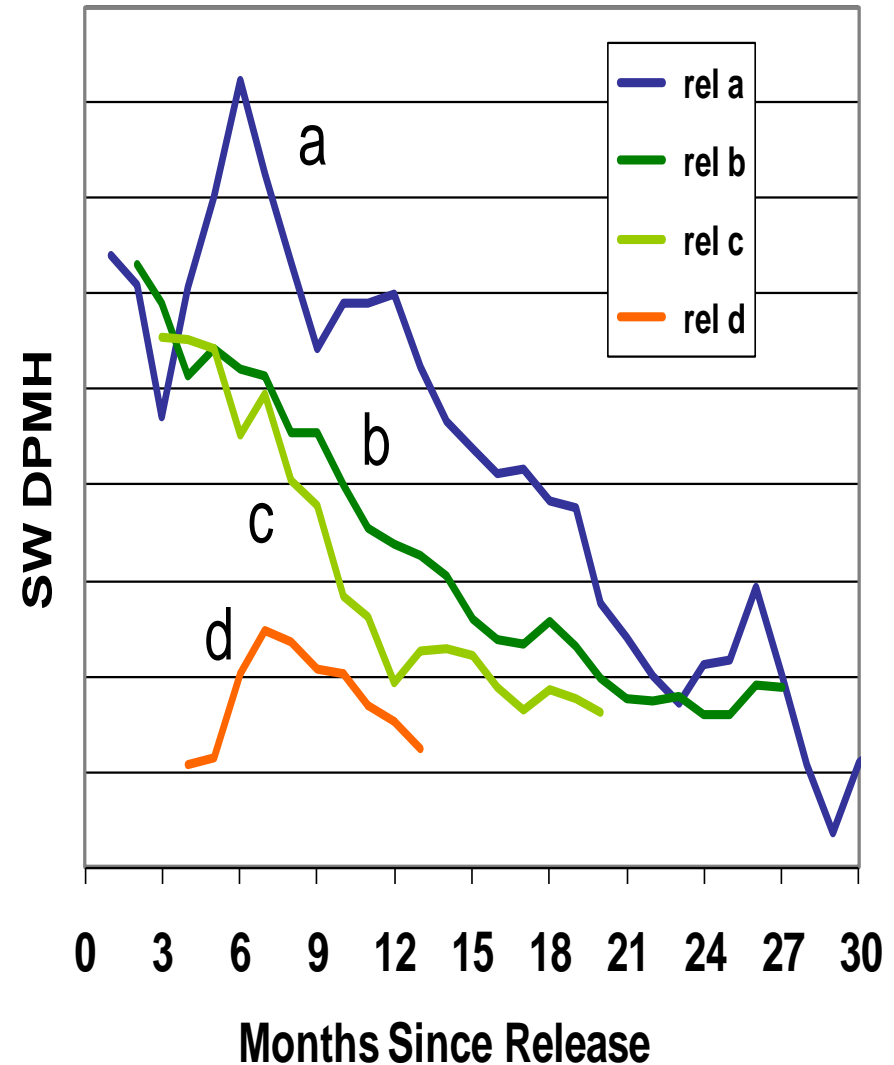
example: standardized static analysis, code review, unit test, and escape detection processes adopted to 95% level in 2 years

internally-found regressions, defect density, peer review effectiveness, and many others are published but not goaled.

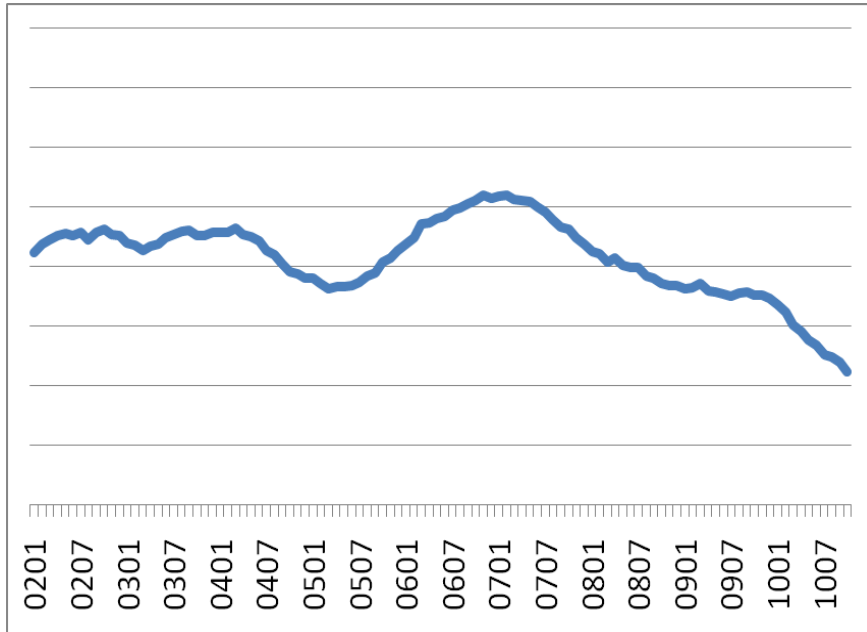
Customer Experience Metrics

primary CE metrics are:

- field faults volume and MTTR (CFDs – customer-found defects)
- field collateral damage (%CFR – customer-found regressions as % of CFDs)
- service requests associated with software defects per million usage hours per month per product (SWDPMH) – see typical reduction, release to release, on this graph:

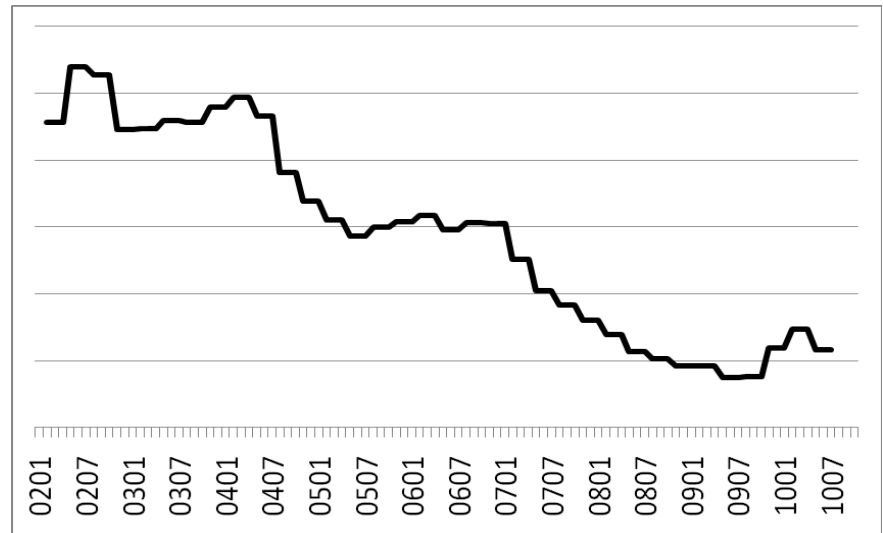


Customer-found Defects Level

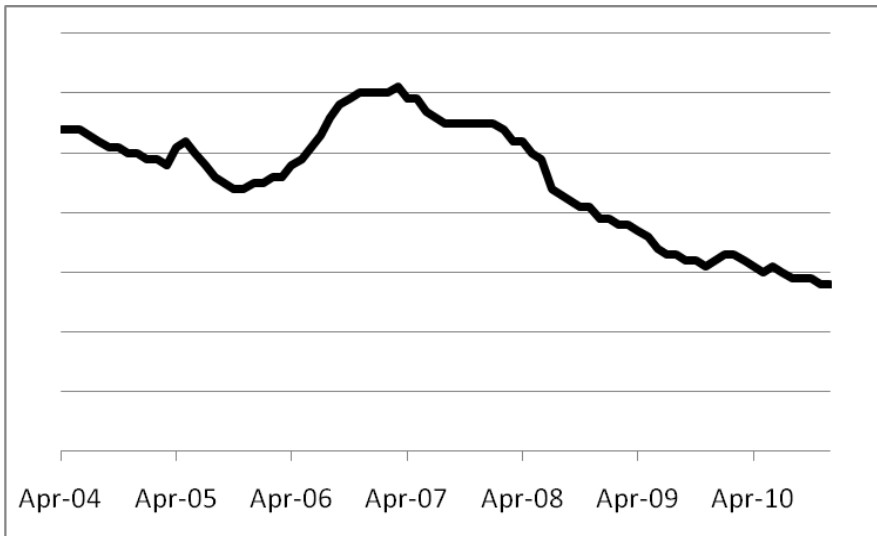


Customer Experience Metrics Results

CFDs Normalized by Product Revenue



% Customer-found Defects Rate



Customer Experience Metrics Results/Goaling

Groups based SW CSAT (as of Q3 FY11)	SWDPMH FY11 Average Progress	SWDPMH FY12 Recommended Average Goal	SRs/Install Base FY11 Average Progress	SRs/Install Base FY12 Recommended Average Goal
SW CSAT > 4.4	-17%	0%	-16%	0%
4.0 =< SW CSAT <= 4.4	-29%	-29%	-18%	-18%
SW CSAT < 4.0	-14%	-15%	-9%	-10%
No CSAT	-15%	-15%	-16%	-16%
Summary	-24%	-22%	-16%	-14%

These recommendations are averages for each of the 4 groups.
We anticipate that teams may adjust their goals based on the product's position in the SW CSAT range and on relevant business factors.

Customer Perception Metrics

customer satisfaction survey (CSAT) has evolved over >15 years, and includes satisfaction with software, hardware, technical support, account team, etc.

130,000 respondents yearly

software and total CSAT is a factor for all Cisco employees' yearly bonuses

CSAT includes questions about many software characteristics:

- reliability
- ease of use
- time to adoption
- diagnostics
- upgrade & installation
- lead time
- performance
- documentation
- interoperability
- technical support
- security features
- features/functionality
- technical innovation
- high availability

Customer Perception Metrics

we are using linkages modeling to ascertain the influence of specific development and test practices on customer experience and perception

this enables us to better invest in practices that demonstrably make a difference to CSAT and eventually to market share and revenue.

customer perception metric – software CSAT

correlations of r-squared = ~0.45 for major feature releases
= ~0.35 for major product families

customer experience metric – SWDPMH

r-squared = >70% for Unit Test Escapes
Development Defect Density
Release-gating Bugs
Mean Time To Repair
Code Review Escapes
= 50 – 70% for 4 other metrics.

in-process (engineering) metrics

Step 4: Include Customer Experience Metrics from Trouble Tickets

~30% of software customer satisfaction is the result of software reliability

other customer experience aspects contribute the remainder

trouble ticket (service request) metrics gauge experience in these categories (mapped from CSAT attributes):

- reliability
- ease of use
- time to adoption
- diagnostics
- upgrade & installation
- lead time
- performance
- documentation
- interoperability
- technical support
- security features
- features/functionality
- technical innovation
- high availability

Service Requests Mining: iSRV

CDO_SR Metrics_2010_APR_SAVTG.xlsx

TS Customer and Business Intelligence

CDO SR Metrics Tool



[Back to summary page](#)

[Raw data view](#)

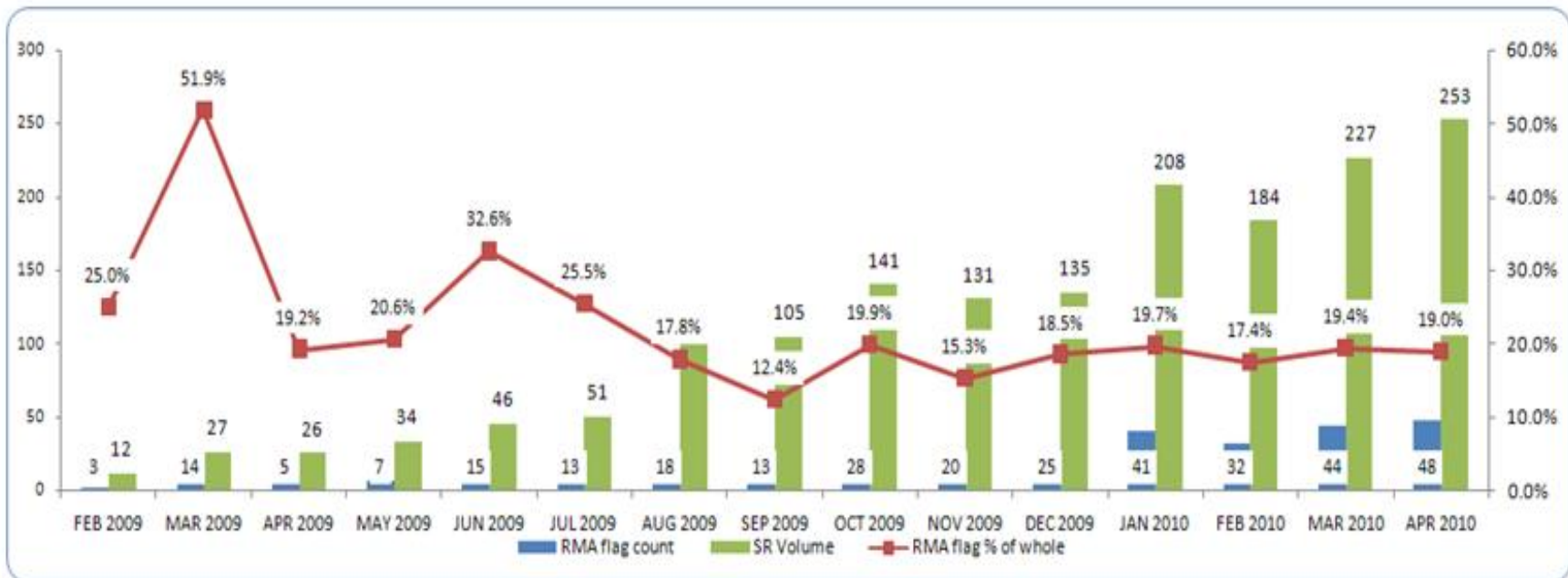
Initial Severity 1 or 2 - volume vs % of whole

Outage = Yes - volume vs % of whole

RMA flag volume vs % whole

Defects flag volume vs % whole

SR ENT Technology Group		Theater	(All)	Outage	(All)
SR ENT Business Unit	(All)	HW PID	(All)		
SR ENT Product Family		SR Type	(All)		TAC and SMB



Step 5: Overcome Rear-guard Actions by the BUs

BUs' attitude reminiscent of Kubler-Ross's stages of grief:

- denial – 'the data is wrong'
- anger – 'the metrics are inappropriate'
- bargaining – 'the goals are inappropriate'
- depression – appeal to the GM
- acceptance – 'OK (but we still don't like it much)'

... and we often iterate back to denial, etc., again and again.

Next

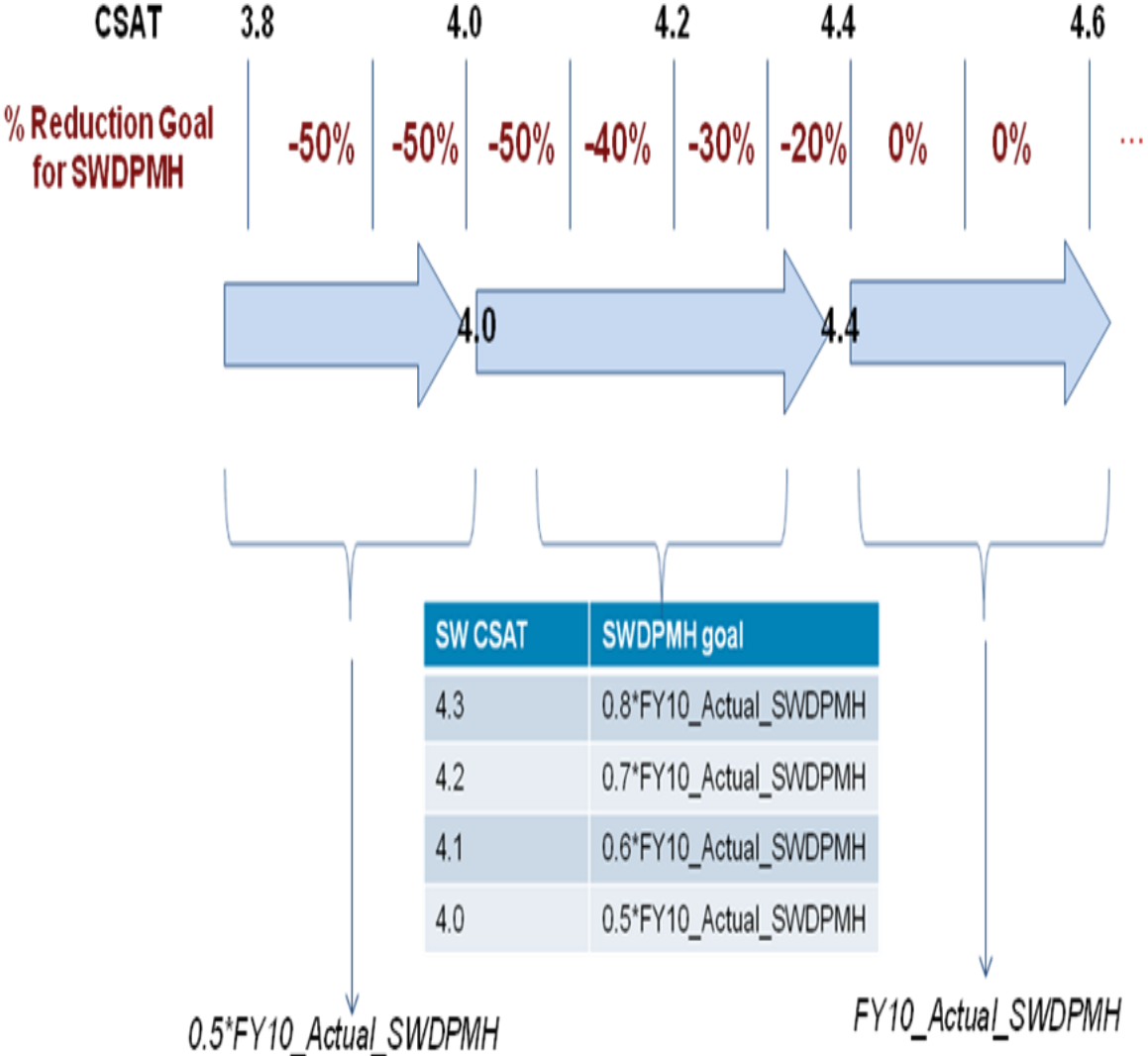
- focus on the product dimension
- pin BIC to CSAT when possible
- reach BIC for all common metrics by 2013
- continue to expand beyond reliability
- link best practice metrics to customer experience and perception
- focus on new products and those with chronic quality problems
- monetize perception, experience, and in-process metrics using linkages.

Backup

Dimensions

organization	primary dimension until 2009
product	expectation that this will be primary in late-2012
release	drilldowns from org and product views now; full release view expected in 2013
component	not enabled across all of Engineering
business unit	metrics and goals for BUs hosted on SWQD.

Best-in-class (BIC) Example



Customer Perception Metrics: Linkages

Lever Metric	Product A	Product B	Product C
Unit Test Escapes	VS	VS	M
Development Defect Density	M	VS	M
Release-gating Bugs (OIB,S1,SS)	VS	M	W
MTTR	VS	W	S
Code Review Escapes	W	S	VS
Open Bugs at FCS	S	W	S
% IFR	W	S	W

vs = Very strong lever ($r^2 = 70-93\%$)

s = Strong lever (50-70%)

m = Moderate lever (30-50%)

w = Weak lever (0-30%)

In-proces Metrics	Suggested Actions (incomplete list)
Unit Test	<ul style="list-style-type: none"> More focus on unit test during development RCA of unit test escapes to discover weak areas Training / adoption of best practices around unit test Unit (white box) testing removes internal-structure/all-paths bugs
Code Review	<ul style="list-style-type: none"> More focus on code review during development RCA of code review escapes to discover weak areas Training / adoption of best practices around code review Formal inspection identifies (removes) many common bug types
Development Defect Density (DDD)	<ul style="list-style-type: none"> Begin tracking DDD in your org if not already Set DDD thresholds and do PPAs on projects that exceed that value Employ dev phase containment practices (resolve all static analysis warnings, run unit tests / code reviews, fix all Sev1/2 and SS/TS bugs before handoff to devtest) Under consistent testing conditions, DDD measures bug injection rates
OIB's and other release-gating bugs (i.e., S1, SS)	<ul style="list-style-type: none"> Engage Advanced Services to identify OIBs early in the process Address all release gating bugs prior to FCS Identification and removal of the most toxic bugs
Open S1-3@FCS	<ul style="list-style-type: none"> Tighten commit and release/throttle pull criteria Fix defects earlier in the process Identification and removal (or deferral) of serious and critical bugs
MTTR	<ul style="list-style-type: none"> Achieve / maintain corporate standard 28-day MTTR Steady-state bug removal indicator; efficacy of sustaining effort
Regressions	<ul style="list-style-type: none"> Set aggressive regression reduction goals RCA regression defects to discover sources of collateral damage Implement architecture / process changes to reduce collateral damage in future releases Injection reduction while bug fixes are made, inspected, and tested.

